MOTOROLA INC. COMMUNICATIONS DIVISION • **INSTRUCTION MANUAL**

DC remote

MOTOROLA

REMOTE CONTROL DESK SET

T1375A T1376A

T1377A T1378A

T1379A T1380A

117 VAC & 12 VDC OPERATION

68P81053A60-F

MOTOROLA

REMOTE DESK SET

MODELS T1375A

T1376A

T1377A

T1378A

T1379A

T1380A

Remote Desk Set

MOTOROLA INC. **Communications Division**

ENGINEERING PUBLICATIONS 1301 E. ALGONQUIN ROAD SCHAUMBURG, ILLINOIS 60172

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Printed in U.S.A.
7/30/74-PO

68P81053A60
Issue - F

GUARANTEED PERFORMANCE SPECIFICATIONS

GENERAL

POWER INPUT 117 V AC	Transmit	15 watts
	Receive	7 watts
	Standby	5 watts
POWER INPUT 12 V DC	Transmit	600 ma
	Receive	170 ma
	Standby	75 ma
DC CONTROL CURRENTS		F1 Push-to-Talk: Up to +15 ma fixed or +5.5 ma adjustable. F2 Push-to-Talk: Up to +15 ma fixed. Monitor: -2.5 ma adjustable
WEIGHT		Approximately 5 lbs.
DIMENSIONS		5" high x 9-3/16" deep x 9" wide

TRANSMIT

MICROPHONE INPUT	Dynamic-Type Cartridge in handset
FREQUENCY RESPONSE (1000 cps reference)	+1, -3 db @ 300-3000 cps
COMPRESSION	With audio input increase of 30 db beyond start of compression, output level increases less than 3 db.
SIGNAL TO NOISE	More than 50 db
AUDIO OUTPUT	18 dbm at less than 3% distortion with 30 db of compression into a 600-ohm load from 95 to 145 V AC input.

RECEIVE

INPUT	600-ohm line (balanced)
AUDIO INPUT LEVEL FOR START OF COMPRESSION	Adjustable, maximum sensitivity: -20 dbm @ 1000 cps
FREQUENCY RESPONSE (1000 cps reference)	+1, -3 db, 300-3000 cps
COMPRESSION	With audio input increase of 30 db beyond start of compression, output level increases less than 3 db.
SIGNAL TO NOISE	better than 45 db
AUDIO OUTPUT	500 mw min into a 16 ohm load @ less than 5% distortion with 30 db of compression from 95 to 145 V AC
TRANSFORMER LINE BALANCE	70 db @ 1000 cps
LONGITUDINAL HUM REJECTION	Signal to noise is better than 35 db with 100 V AC, 60 cps line to ground.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

FOREWORD

SCOPE OF INSTRUCTION MANUAL

This manual offers descriptive and service information for the radios described in it. Service diagrams, parts lists, and printed circuit board details are also included.

NOMENCLATURE

Motorola radio equipment is specifically identified by the model number on the nameplate.

NOTE

Be sure to use the entire model number when making inquiries about your equipment.

Identifiers have been assigned to chassis and kits. Use these identifiers when requesting information or ordering replacements.

PRODUCTION CHANGES

When production and engineering changes are incorporated into the equipment, a revision numeral is assigned to the chassis or kit affected.

Typical Example:
The Model TRD1432AA becomes TRD1432AA-1 with the first revision.

This chassis number complete with revision numeral, if any, is stamped on the chassis at the time of production. The revision numeral becomes an integral part of the chassis identifier.

INSTRUCTION MANUAL REVISIONS

Changes which occur after an instruction manual is printed are described in the Instruction Manual Revision. These bulletins give the reader complete information on the change including pertinent parts listing data.

CAREFUL USE OF THE INSTRUCTION MANUAL AND THE MANY SUGGESTIONS CONTAINED IN IT WILL FURTHER INSURE PROPERLY INSTALLED AND MAINTAINED RADIO EQUIPMENT.

68P81002E32-F

PARTS AND SERVICE

REPLACEMENT PARTS ORDERING

ORDERING INFORMATION

Motorola maintains parts depots strategically located throughout the country. These facilities are fully equipped to give the finest service. Orders for all parts except crystals, channel elements, and "Vibrasender" and "Vibrasponder" resonant reeds should be sent to the nearest parts depot. Orders for crystals, channel elements and reeds should be sent to the factory address listed. Orders for instruction manuals should also be sent to the parts and service depots.

When ordering replacement parts, the complete number identification of the item must be used whether it be a component, kit or complete chassis. This will fix proper identification and assure delivery of the desired item. Complete number identification should also be used when requesting equipment information.

Crystal and channel element orders should specify the crystal or channel element type number, crystal frequency, carrier frequency, and the chassis model number in which the part is used.

Orders for "Vibrasender" and "Vibrasponder" resonant reeds should specify type number and frequency and should identify the owner/operator of the communications systems in which these items are to be used.

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Communications Division Parts Department
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Executive Offices: 1301 E. Algonquin Road, Schaumburg, Illinois 60172

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Parts Department
3125 Steeles Avenue East Willowdale, Ontario
Phone: 416-499-1441 · TWX: 610-492-2713
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FACTORY ADDRESS FOR CRYSTAL, CHANNEL ELEMENT AND RESONANT REED ORDERS

AIR MAIL ORDERS	REGULAR MAIL ORDERS AND CORRESPONDENCE
Motorola, Inc. Component Service Department P.O. Box 66191 O'Hare International Airport Chicago, Ill. 60666	Motorola, Inc. Component Service Department 2553 Edgington Street Franklin Park, Illinois 60131

SERVICE

Motorola provides a nation-wide service organization. Through its maintenance and installation program Motorola makes available the finest service to those desiring reliable continuous communications on a contract basis.

The largest service organization specializing in mobile communications is Motorola's National Service Organization. Over 800 strategically located, adequately staffed and trained, independently owned and operated stations manned with several thousand FCC licensed personnel constitute the sub-contracting force.

The administrative forces of area and district service managers and district service representatives are in the direct employ of Motorola.

For your contract service requirements, please contact your local Motorola representative or write to:

National Service Manager
Motorola Communications Division
1301 E. Algonquin Road, Schaumburg, Ill. 60172

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MODEL CHART

CODE:

[X] = ONE SUPPLIED

◪ = ONE SUPPLIED, CHOICE DEPENDENT ON COLOR

*REPRESENTS A SERIES OF MODELS AND NOT A SPECIFIC MODEL. THE SPECIFIC MODEL NUMBER INCLUDES A SUFFIX WHICH DENOTES THE COLOR OF THE EQUIPMENT AS SHOWN BELOW:

MODEL SUFFIX LETTERS	COLOR OF DESK SET
AA	BLACK
AB	RED
AC	GREEN
AD	BLUE
AE	BEIGE
AF	WHITE

		117 V AC MODELS			117 V AC/12 V DC MODELS		
	DESCRIPTION	REMOTE DESK SET	REMOTE DESK SET WITH INTERCOM AND MONITOR SWITCHES	REMOTE DESK SET WITH INTERCOM, MONITOR AND F1-F2 SWITCHES	REMOTE DESK SET	REMOTE DESK SET WITH INTERCOM AND MONITOR SWITCHES	REMOTE DESK SET WITH INTERCOM, MONITOR AND F1-F2 SWITCHES
ITEM	DESCRIPTION / MODEL	*T1375	*T1376	*T1377	*T1378	*T1379	*T1380
TLN1188A	DESK SET CHASSIS (117 V AC)	X	X	X			
TLN1189A	DESK SET CHASSIS (117 V AC/12 V DC)				X	X	X
TLN8694A	GRILLE AND HARDWARE	X	X	X	X	X	X
TLN8691A	INTERCOM SWITCH		X	X		X	X
TLN8692A	MONITOR SWITCH		X	X		X	X
TLN8693A	F1-F2 SWITCH			X			X
TKN6323A	BATTERY CABLE (117 V AC/12 V DC)				X	X	X
TLN8680A	HOUSING AND HANDSET (BLACK)	◪	◪	◪	◪	◪	◪
TLN8681A	HOUSING AND HANDSET (RED)	◪	◪	◪	◪	◪	◪
TLN8682A	HOUSING AND HANDSET (BROWN)	◪	◪	◪	◪	◪	◪
TLN8683A	HOUSING AND HANDSET (BLUE)	◪	◪	◪	◪	◪	◪
TLN8684A	HOUSING AND HANDSET (BEIGE)	◪	◪	◪	◪	◪	◪
TLN8685A	HOUSING AND HANDSET (WHITE)	◪	◪	◪	◪	◪	◪

EPD-20313-A

DESCRIPTION

GENERAL

The T1375A-80A Series Remote Desk Sets provide complete facilities for remote operation of a carrier-squelch or "Private-Line" tone-coded squelch base station. It may be used as the "control point" operating position when used alone or as a "dispatch point" when connected in parallel with other remote desk sets. It may also be used in applications where aural monitoring of all communications at a specific operating point is required. Refer to the INSTALLATION section of these instructions for information regarding FCC Requirements for "control point" and "dispatch point" usage.

The unit is a desk-type telephone set that is available in six different colors for matching surrounding decor. It has a built-in speaker, a dynamic microphone cartridge containing a transistorized pre-amplifier, a coiled retractile cord, a transistorized monitor amplifier and a power supply. Models are available for ac or ac/dc operation. The ac models operate from a 117-volt ac power source. The ac/dc models operate from either a 117-volt ac source or a 12-volt dc power source. The ac/dc models are for use in installations where communications must be operational during ac power failures.

Depending on the model, the remote desk set is available with the following features:

---"Private-Line" disabling switch which permits monitoring of the channel before transmitting.

---Intercom switch which permits two-way intercommunication between the unit and other operating positions equipped with the necessary intercom circuitry.

---F1-F2 switch which permits remote control of a base station having a two-frequency transmitter.

---Emergency power switch which permits operating from a dc source during an ac power failure.

INSTALLATION

1. EXCERPTS FROM FCC REGULATIONS

With respect to the industrial services, each transmitter must be installed and protected in a manner to prevent access to or operation of the station by persons other than those duly authorized by the licensee. Each station must have a control point and may, with authorization of the Federal Communications Commission, have further control points. A control point is an operating position which meets certain conditions: It must be under the control and supervision of the licensee; it must have either a carrier operated device to provide continuous visual indication when the transmitter is radiating or a pilot lamp or meter which will provide continuous visual indication when the transmitter control circuits have been placed in a condition to produce radiation; and it must have facilities which will permit the person responsible for the operation of the transmitter to turn the transmitter carrier on and off at will.

A dispatch point is any position from which messages may be transmitted under the supervision of the person at a control point who is responsible for the operation of the transmitter. Dispatch points may be installed without authorization from the Commission. If dispatch points are installed in the system, the control point must be equipped to permit the person responsible for the operation of the transmitter to monitor all transmissions originating at dispatch points under his supervision. The control point must also have facilities which will permit the person responsible for the operation of the transmitter either to disconnect the dispatch point circuits from the transmitter or to render the transmitter inoperative from any dispatch point under his supervision.

FCC Regulations require that certain records be maintained. Maintenance and transmitter measurement records must be kept for the base station. Additionally (unless the station is authorized to operate at temporary locations), it is necessary for the base station operator and all control point operators, when they communicate with other base stations, to maintain a log showing call signs of other base stations and the date, time and approximate duration of each transmission.

2. COMPLIANCE WITH FCC REGULATIONS

To fulfill the requirements of FCC rules and regulations, the T1375A - 80A Series Remote Desk Sets may be connected in one of the following manners:

a. Control Point

One remote desk set may be connected directly to the base station as the only operating point. In this type of system, the remote desk set is the "control point". The base station may not legally be locally operated in such a system.

b. Dispatch Point

Several remote desk sets may be installed as dispatch points when it is desired by the station licensee that the dispatch points be able to monitor both sides of each communication and have intra-system intercom capability. In this type of system, the remote desk sets are connected in parallel to a remote control console, which is designated as the control point. Therefore, the remote control console must have supervisory control features and a visual indication of when the transmitter is activated.

3. WIRE LINE CONSIDERATIONS

a. Communication Channels

The communication channels available for remote control operation of two-way radio equipment are usually obtained from the facilities installed for normal telephone services. These facilities consist of conductors of various gauges, non-loaded and loaded circuits and may contain repeating coils, composite sets or other intermediate equipment. For these reasons the resistance, impedance and transmission-frequency characteristics of channels differ, depending upon the location of the terminals of the available facilities. Also as communications systems change and improvements are made, the characteristics of the channels available between two points may be changed.

Channels for service up to approximately twenty miles are usually obtained from cable facilities. Metallic paths are generally employed for such channels when speech or tones in the voice range are to be transmitted. When initially connected, it may be found that the pair does not transmit dc. The telephone company may have repeating coils installed in the line, therefore it may be necessary to provide for dc transmission. The T1375A Series Remote Desk Set is designed to provide dc control over the same pair as used for audio (two wire control). If absolutely necessary, however, separate wires can be used for dc control (four wire). When circuits are longer than

twenty miles, the telephone company may be unable to provide communications circuits which will transmit frequencies below 250 cycles; therefore the dc control will have to be on a separate pair. The upper limit of the frequency band transmitted is generally limited by the cut-off frequency of loading systems which is approximately 2750 cycles to 3500 cycles. Where non-loaded facilities are employed for channels above 3000 cycles, the telephone company may load these circuits for general service reasons.

The remote desk sets are designed to meet all telephone company specifications, regarding specific levels and dc voltages impressed on the line.

b. Speech Volume Level

Most telephone companies require that speech levels be transmitted at +8 vu, as read with the Standard Volume Indicator (vu meter). This is the equivalent of +14 dbm (3.9 volts) as read with an ac voltmeter across the line output when terminated in 600 ohms impedance.

c. Impedance

In most applications, a non-loaded cable is used for the shorter circuits. This type of facility is used for speech transmission with equipment designed for use with 600-ohm circuits. For circuits longer than fifteen miles, a loaded cable is usually required and the impedance may vary up to 2000 ohms. In unique cases, ratio repeating coils are used to match the loaded facilities to the 600-ohm equipment. Ordinarily, mismatches will cause no serious difficulty. However, in extreme cases, excessive peaks and valleys may appear in the response which can be corrected by insertion of ratio repeating coils between sections of loaded and non-loaded cable.

4. INSPECTION

Unpack the equipment and inspect it thoroughly as soon as possible after delivery. If any part of the equipment has been damaged in transit, report the extent of the damage to the transportation company immediately.

This unit has been inspected and adjusted at the factory to its recommended operating condition. Unless it has been handled roughly in transit or otherwise abused or tampered with, it will require no further adjustment and other than completing the external connection procedures outlined in the following paragraphs, the unit is ready for operation.

5. REMOTE DESK SET CONNECTIONS

a. Equipment Location and Housing Removal

(1) Place the unit at the approximate location which is to be the operator's position. This should be a flat desk-top surface and should be located near the control line cable entry.

(2) Remove the housing by unscrewing the two slotted head screws on the base plate and removing the VOLUME control knob.

NOTE

Before making any connections to the line terminals, fasten the control line cable with the squeeze clamps provided.

b. Two-Wire Control

Route the control line cable above the ac line cord and connect it to terminals A (+DC) and D (-DC) Make sure that the correct polarity is observed. This can be checked by referring to the functional diagram of the remote base station. It may be impossible to determine the polarity of the control line pair wires due to the length and routing of the lines between the base station and the remote desk set. Therefore, it is recommended that the connections be made arbitrarily and if the control functions do not operate, or operate incorrectly reverse the connections at terminals A and D.

c. Four-Wire Control

(1) Cut jumpers JU1 and JU2 on the amplifier board (refer to jumper chart).

(2) Route the control line cable above the ac line cord. Connect the audio line pair to terminals A and D.

(3) Connect the dc control line pair to terminals B (+DC) and C (-DC). Be sure that the correct polarity is observed. This can be checked by referring to the functional diagrams of the remote base station. Due to the length and routing of the control line pair, it may be impossible to determine the correct polarity. Therefore, arbitrarily connect the dc control line pair to terminals B and C. If the remote control functions do not operate, or operate incorrectly, reverse the connections.

d. Power Connection

Connect the power cord to a convenient 117-volt, 60-cycle power source. Once the ac power is connected, the remote desk set may be placed in operation. For optimum equipment operation, it

is recommended that a three-wire power system or an appropriate grounded power plug adapter be used. On ac/dc models, connect the ac cord as above and route the TKN6323A Battery Cable to the terminals on the bottom side of the base plate; connect the cable to the appropriate terminals. Connect the other end of the battery cable to the negative and positive terminals of the emergency battery respectively. A 12-volt automotive type storage battery is recommended for emergency power.

e. Parallel Remote Desk Set Connections

Up to ten remote desk sets may be connected in parallel, as dispatch points, to a control point remote control console. To obtain the line levels required by the remote desk sets, compensation must be made for the telephone line losses. Refer to the Adjustment Procedure in these instructions for line level adjustment information. The remote desk sets should be used with telephone lines having an impedance of 600 ohms. The paralleled remote desk sets should be installed far enough apart to prevent audio feedback between the microphones and speakers. Use a two-wire control line system to connect the remote desk sets in parallel and to the remote control console. Connect the control line to the A and D terminals on each remote desk set and to the supervisory terminals on the remote control console. Cut jumper JU4 on all of the paralleled remote desk sets.

f. Test Point Terminal

The AUDIO "A" test point, pin 46, is connected directly to the output of the compression amplifier. This terminal provides a convenient test point for sampling the unswitched audio output of the compression amplifier. During normal receive or transmit operation, this terminal should provide a 0.8-volt rms indication.

NOTE

When this unit is used with a relay-type remote control unit with a "PL" disable function, R30 must be changed to 39K, 1/2 watt. This applies to all remote control units except TLN1126A suffix-1 or later.

JUMPER CHART

JUMPER	APPLICATION
JU1 & JU2	Cut both jumpers when remote desk set is used for four-wire telephone line operation and both pairs are dc continuous.
JU3	Factory cut for intercom models only.
JU4	Cut in remote desk sets that are paralleled for dispatch point operation.

PRE-OPERATIONAL ADJUSTMENTS AND LEVEL SETTINGS

1. STANDARD REFERENCE LEVEL

a. General Considerations

The common terms which are used to express audio power levels in a communication system are "dbm" and "vu". Another term which is often misused in this connection is the "db". It is important that the correct term, or unit of measurement, be used as determined by its application.

In a two-way radio communication system, the audio levels between various radio installations and control points must be adjusted for the specific applications to assure optimum performance.

When adjusting audio levels, it must be remembered that speech is a complex non-periodic waveform which is difficult to measure. The fluctuations, the damping characteristics of the meter, and the technique of reading the meter will all influence the final values of the audio level settings. It is the purpose of this explanation to provide the serviceman with a good understanding of the reference level terms which will be used in making the adjustments described in this section.

b. DB (Decibel) - Power or Voltage Ratio

The decibel (db) is a ratio and is defined as a unit of measure such that:

$$\text{db (power)} = 10 \log \frac{P_A}{P_B} \text{ or}$$

$$\text{db (voltage)} = 20 \log \frac{E_A}{E_B}$$

where P_A and P_B are two values of power, or E_A and E_B are two values of voltage. Note that since db is a ratio, it has no unit value such as volts, amps or watts. Be careful not to use this term in referring to a specific audio level as has been the practice in some instances.

c. DBM - Decibel Referred to 1 Milliwatt

DBM is a symbol indicating a power level with respect to 1 milliwatt. It shows the number of db (ratio) above or below 1 milliwatt. Zero dbm is equal to 1 milliwatt. Although this definition does not necessarily imply 600-ohm impedance, most ac voltmeters are calibrated in terms of dbm across 600 ohms. In this case, using the formula $P = \frac{E^2}{R}$ we get:

$$.001 \text{ watt} = \frac{E^2}{600} \text{ or } E = .77 \text{ volt across}$$

600 ohms for 1 milliwatt = "0" dbm

Since ac voltmeters are also calibrated in volts, note that "0" dbm corresponds to .77 volt on the scale.

The above dbm terminology can only be used with a steady state sine wave signal on a 600-ohm line. For other line impedances, a correction factor ($10 \log \frac{600}{Z}$) must be applied for the true dbm reading.

Since "0" dbm is a special definition of the db equation, any level above or below it has the same db relationship to zero as the dbm value itself. For example, +6 dbm of signal is 6 db above 0 dbm. In voltage terms this would be 6 db above 0.77 volt which is 1.54 volts (refer to the Conversion Chart).

d. Conversion Chart

Zero dbm is the accepted standard reference level as defined previously. This reference will be found on an ac voltmeter calibrated for use across 600 ohms as "0" dbm or 0.77 volt on the voltage scale. This is equivalent to 1 milliwatt of power. Eight dbm occurs at 1.9 volts on the voltage scale and is equal to 6 milliwatts of power.

CONVERSION CHART

1 MW - 600 Ohms Reference Level Volts	dbm or db	6 MW - 500 Ohms Reference Level Volts
7.74	+20	17.320
6.15	+18	13.760
4.88	+16	10.930
3.88	+14	8.681
3.08	+12	6.895
2.44	+10	5.477
1.94	+ 8	4.351

CONVERSION CHART (Cont'd)

1 MW - 600 Ohms Reference Level Volts	dbm or db	6 MW - 500 Ohms Reference Level Volts
1.54	+ 6	3.456
1.22	+ 4	2.745
0.97	+ 2	2.181
0.77	0	1.732
0.61	- 2	1.376
0.48	- 4	1.093
0.38	- 6	0.861
0.30	- 8	0.689
0.24	-10	0.547
0.19	-12	0.435
0.15	-14	0.345
0.12	-16	0.274
0.09	-18	0.218
0.07	-20	0.173

Older ac voltmeters were calibrated to a 6 milliwatt reference level across a 500-ohm line. This level was commonly called "0 db" and occurred at 1.7 volts on such meters. Either 8 dbm (modern reference nomenclature) or "0 db" (old standard) are equal to the same power level, that is, 6 milliwatts. The conversion chart relates these differences for convenience and understanding of the new and old reference levels.

e. Measuring Speech on the Line

An ac voltmeter may be used to measure speech on the line. This method can only be used if the proper condition and correction factors are used. AC voltmeters vary greatly in their speed of response (damping) and consequently will not give a true reading on voice peaks. When an ac voltmeter is used, a 1000 cps sine wave tone must also be used as the sample signal source through the remote desk set for proper accuracy. The instantaneous peaks of a speech wave are equivalent to the instantaneous peaks of a sine wave which have an rms value 6 db higher, when transmitted through a compression system. Therefore, a 6 db correction factor must be applied when using this method. In other words, +8 vu of speech will be measured as +14 dbm (3.9 volts) on an ac voltmeter across the 600-ohm line with a 1000 cps tone transmitter through the compression amplifier at a level which is in compression. Connect the 1000 cps audio oscillator across terminals J and H. Connect an ac voltmeter across the output of the oscillator and another across the output lines. While increasing the output level of the oscillator, watch both meters. Both meter readings should rise simultaneously until a point is reached where the meter across the output lines no longer reflects

an increase, even though the indication at the meter across the oscillator shows a rise. This point is the "knee of compression" and it is at this point that the LINE OUT level should be adjusted. Repeat this procedure until the oscillator level that drives the amplifier into compression is determined. With this level being fed into the compression amplifier, adjust the LINE OUT potentiometer until the ac voltmeter across the output lines indicates +14 dbm.

2. COMPRESSION AMPLIFIER

The amplifier section is of the compression type and requires no adjustment. It provides a relatively constant amplitude output within the limits of its operational characteristics. A signal input increase of 30 db results in less than 3 db change at the output.

When a certain input voltage is reached, as determined by the biasing network of the compression amplifier, a further input voltage increase will not result in a further output voltage increase. This action is illustrated in Figure 1. In a linear amplifier, an increase in the input voltage results in a proportionate increase in the output voltage. The dashed portion represents how the curve would continue with a linear type amplifier. The solid line curves represent the departure from linear operation.

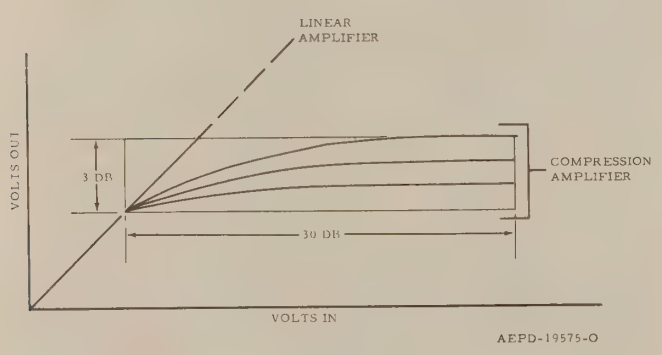


Figure 1.
Typical Compression Amplifier Response

3. LINE OUTPUT LEVEL

a. General Information

The purpose of this adjustment is to provide the correct audio signal level to the remote control line when transmitting. Most telephone companies prescribe a maximum of +8 vu of speech on the lines. This is to prevent crosstalk between pairs in the cables and overhead lines. It is wise to operate your unit at the maximum permissible output level since this will result in the best possible signal-to-noise ratio on the line. Make sure the unit is terminated with the 600-ohm line (terminals A and D) while making this adjustment.

b. Adjustment Procedure

The remote desk set must be keyed (transmitting) for this adjustment. This can be done by grounding terminal E. Connect an ac voltmeter across the line terminals, A and D, and inject a 1000 cps sine wave signal into the microphone input circuitry, terminals J and H. This signal should be at a 1 volt level to assure that the signal drives the compression amplifier into compression. Set the LINE OUT control for +14 dbm (3.9 volts) which is the equivalent of +8 vu of speech. If a +14 dbm level is not desired, set the control for the desired level.

4. LINE INPUT LEVEL

a. General Information

These adjustments are required for correct operation of the compression amplifier on received signals. It is assumed that the base station receiver line level control has been properly adjusted at the station site. This adjustment, described in the base station instruction manual, is a necessary prerequisite to the line input level adjustment. The LINE IN level control should be adjusted to a level just below the point where compression begins. The amplifier will then reproduce normal signals at an adequate level for comfortable listening with negligible compression. If this level is set too high, the amplifier will operate in compression all of the time and consequently normal signals will sound unnatural. Compression will also reduce the effective signal-to-noise ratio. This is especially important in systems with "Private-Line" operation where the coding tone audibility will be increased by the same number of db as the voice signal is compressed. Intercom signals are normally higher in level than the remote station signals because of the proximity of their source. Therefore, they will drive the amplifier into compression most of the time. In these instances, the compressor prevents the intercom message from "blasting".

b. Adjustment Procedure

NOTE

Remove (clip out) resistor R36 for line input levels above 0 dBm (.77 V) at the input to the desk set.

Connect an ac voltmeter between pin 46 and ground. Pin 46 is the AUDIO "A" test point at the output of the compression amplifier. Apply a

1000 cps sine wave at a +14 dbm level to the control line at the base station end as described in the base station instruction manual. Turn the LINE IN control fully clockwise and observe the reading on the voltmeter which should be approximately 0.8 volt rms. Turn the LINE IN control counterclockwise until the reading on the voltmeter just begins to decrease. This is the compression point of the amplifier.

A listening test may be used as an alternate method to make this adjustment. With the base station receiving a signal from another radio in the system that has been correctly adjusted, advance the LINE IN control clockwise (from the fully counterclockwise position) audio level from the speaker begins to "flatten". For systems that have parallel operating points, the listening test should be made using the input signal from the operating point that provides the lowest input signal level.

5. BASE STATION LINE INPUT CONTROL ADJUSTMENT

a. General Information

The line level adjustment is located in the base station on its remote control chassis. The adjustment of this control is described in the base station instruction manual. However, the success of all of the remote desk set adjustments previously described are dependent upon the correct setting of this control at the base station. Therefore, its adjustment procedure is repeated here to emphasize its importance.

Up to this point, the remote desk set has been adjusted to provide the correct signal into the audio transmission line. Some of this signal will be lost down the line depending upon its nature and length. At the base station end of the line, the line level control (on the remote control chassis) acts as an attenuator to set the correct amount of signal into the audio circuit of the transmitter. The setting of this control will depend upon the amount of signal put into the line at the sending end and the length of the line.

b. Adjustment Procedure

NOTE

If a Motorola TK556 Line Compensator Kit is used, it should be adjusted before making this adjustment.

Connect a high impedance ac voltmeter (Motorola model, or equivalent) across the transmitter audio input terminals. Transmit a 1000 cps test signal from the remote desk set at its maximum permissible output level (normally 14 dbm). Adjust the line level control on the base station for 0.25 volts on the meter. This adjustment will then provide the correct speech level to the transmitter.

6. AUDIO LEVEL ADJUSTMENT SPECIAL CONSIDERATIONS

In multiple installations, that is, where several remote desk sets are in parallel on the control line, the level adjustments are made in the same manner as described for a single unit.

First, determine which unit is farthest (electrically) from the remote control console. Care should be used in determining this as in many instances, due to the location of telephone exchanges and cable routings, the remote desk set physically located the farthest from the remote control console may not be electrically the farthest away.

Once it has been established which remote desk set is electrically the farthest away, this unit is set up exactly as previously described for a single remote desk set. The line input control at the remote control console is set up as previously described for the base station, but only on the remote desk set located the farthest away. It is not changed for setting up the closer remote desk sets. Instead, the LINE OUT level control at each successively closer remote desk set is adjusted to provide a signal at the remote control console. By following this same procedure for each successively closer remote desk set, the input level to the remote control console will be the same regardless of which unit is being used. This compensates for the variation in line losses. At the same time, the compression amplifier prevents the higher audio level of the farthest unit from being too loud in the closer remote desk sets.

7. LINE CIRCUIT ADJUSTMENT

a. General Information

The control currents of the remote desk set are not regulated and, therefore, are dependent on the resistance of the control lines. The current capabilities of the remote desk sets are shown in the following chart.

FUNCTION	CURRENT
F1 Push-to-Talk (one-frequency models only)	Up to +15 ma Fixed or +5.5 ma adjustable
F1 Push-to-Talk (two-frequency models only)	+5.5 ma adjustable
F2 Push-to-Talk	Up to +15 ma fixed
Receiver "PL" Disable (all models with MONITOR switch)	-2.5 ma adjustable

NOTE

The line currents are adjusted at the factory for operation with Motorola base stations which are equipped with solid-state remote control chassis. For any other base station, check your manual for the required current values. Follow the subsequent procedures for check or adjustment.

On Motorola transistorized base stations, the line currents may be measured using the built-in metering and intercom facilities. Refer to the base station instruction manual for details.

b. Connecting Test Equipment

Connect an ammeter at the control lines as shown in Figure 2.

c. Adjustment Procedure

All adjustments are made using the potentiometers on the amplifier circuit board which are accessible through the bottom plate. These adjustments are labelled F1 and MONITOR.

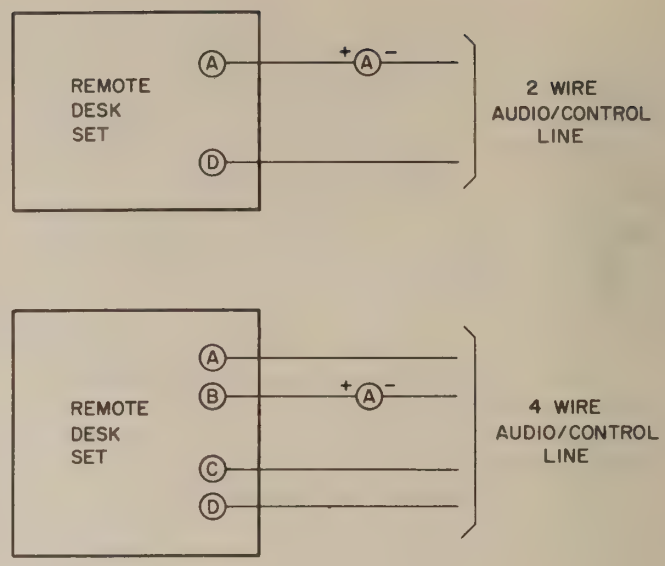
(1) F1 Adjustment

On one-frequency models, this current is fixed at a nominal value of +15 ma into a 5,400-ohm line loop resistance. When a +5.5 ma current is required, remove the gray-green wire from pin 26 and connect it to pin 25. Operate the push-to-talk bar switch and adjust the F1 potentiometer until a +5.5 ma reading is obtained.

On two-frequency models, select F1 on the frequency selector switch and operate the push-to-talk bar switch. Adjust the F1 potentiometer until a +5.5 ma reading is obtained. The push-to-talk current for F2 is not adjustable; it is fixed at a nominal value of +15 ma into a 5,400-ohm line loop resistance.

(2) MONITOR Adjustment

On models equipped with a MONITOR switch, depress the switch and adjust the MONITOR potentiometer until -2.5 ma is obtained.



AEPD-20315-0

Figure 2.
Connecting Ammeter for Line Current Adjustment

OPERATION

1. TURNING ON EQUIPMENT

When the ac primary power source is connected to the remote desk set, it is ready for operation.

2. TO RECEIVE

When the unit is turned on, it is in the receive condition. Adjust the VOLUME control for the desired listening level from the speaker. If the unit includes an F1-F2 switch, place the switch in the desired position.

3. "PRIVATE-LINE" DISABLING

Momentarily operate the MONITOR switch to hear all on-channel signals. If signals are heard, wait until the channel is clear before transmitting.

4. TO TRANSMIT

Lift the handset off the cradle and press the push-to-talk bar switch. The transmit indicator on the speaker grille will illuminate to show that the transmitter control circuits are activated and that the microphone is "live". Speak into the handset mouthpiece in the same manner as into a telephone. Release the bar switch to hear a reply in the handset earpiece.

5. OPERATION WITH EMERGENCY POWER

Set the AC-BATT switch on the chassis base plate to the BATT position if a power failure occurs. Set the AC-BATT switch to the AC position when normal power is restored.

6. INTERCOM

To call other operating points without activating the base station transmitter, press the INTERCOM switch and voice call your party by speaking into the grille speaker. DO NOT lift the handset or operate the push-to-talk bar switch on the handset.

THEORY OF OPERATION

1. GENERAL

On the simplified schematic diagram, the audio amplifier circuits are shown as triangles and the dc control circuits are shown by a schematic representation. All other circuits are shown as rectangles and are identified by name. The audio paths are shown with heavy lines; arrowhead symbols indicate the direction of audio flow.

2. POWER SUPPLY

The power supply consists of a power transformer, a full-wave rectifier and voltage regulation circuitry. When the ac cord is plugged into a 117-volt ac source, power is applied to the primary of the power transformer. The ac voltage at the secondary of the transformer is rectified by a full-wave rectifier. The rectified voltage is then regulated (13.6-volts) and applied to the dc control and amplifier circuits.

When ac/dc powered units are operated from a dc battery source, battery power is applied directly to the dc control and amplifier circuits, bypassing the voltage regulation circuitry.

3. RECEIVE OPERATION

The unit operates in the receive condition when power is applied. The following circuit conditions exist:

---Receive Amplifier Switch Q9 is "on".
---Receive Amplifier Q10 is "on".
---Line Current Switch Q8 is "off".
---Transmit Amplifier Switch Q11 is "off".
---Transmit Amplifier Stages are "off".
---Microphone Bias Switch Q2 is "off".

When the associated base station receives an incoming signal, it is routed via the telephone audio/control lines, the line transformer and the LINE IN potentiometer to Receive Amplifier Q10. Receive Amplifier Switch Q9 is saturated and holds the receive amplifier "on". The output of the amplifier is routed to the input of the compression amplifier which provides a relatively constant output within the limits of its operating characteristics. A signal change of 30 db at the input results in less than a 3 db change at the output.

The output of the compression amplifier is routed to the handset cradle switch. When the handset is on the cradle, audio is routed to the 1/2-watt Receive Amplifier, the VOLUME control, the INTERCOM switch and the speaker. The disabled Transmit Amplifier Switch isolates the output of the compression amplifier from the transmit amplifier circuitry. This prevents audio from reaching the line transformer and interfering with incoming audio. The disabled Line Current Switch prevents generation of dc control line currents.

4. TRANSMIT OPERATION

When the push-to-talk bar switch on the handset is pressed, the following circuit conditions are established:

---Transmit Amplifier Switch Q11 is "on".
---Transmit Amplifier Stages are "on".
---Microphone Bias Switch Q2 is "on".
---Line Current Switch Q8 is "on".
---Receive Amplifier Switch Q9 is "off".
---Receive Amplifier Q10 is "off".

The handset microphone is "live" since the microphone bias switch is "on". When the operator

speaks into the handset, audio is coupled to the input of the compression amplifier. The output of the amplifier is routed through the LINE OUT potentiometer to the input of the transmit amplifier. The output of the transmit amplifier is applied to the line transformer where it is coupled to the telephone audio/control lines.

Line Current Switch Q8 is saturated, causing the current generator circuitry to produce control line currents. These currents are applied to the telephone audio/control lines to activate the base station push-to-talk function.

5. INTERCOM OPERATION

When receiving intercom messages, the unit operates in the same manner as when receiving incoming messages from the base station. When sending intercom messages, the unit operates in the same manner as when transmitting messages through the base station except for the following circuit conditions.

---Microphone Bias Switch Q2 is "off".

---Intercom Amplifier Q3 is "on".

Operation of the INTERCOM switch disables the current generator and switches the speaker to the input of the intercom amplifier for use as a microphone.

MAINTENANCE AND TROUBLESHOOTING PROCEDURES

1. GENERAL

The housing may be removed and the speaker mounting frame may be folded out away from the base plate to expose components. The following procedures and illustrations contain information for gaining access and locating components.

2. REMOVAL PROCEDURES

a. Housing

(1) Remove the knob from the shaft of the VOLUME control.

(2) Place the unit face down on a padded surface.

(3) Remove the two slotted head screws from the base plate.

(4) Lift the base plate away from the housing.

b. Handset

(1) Remove the housing.

(2) Remove the five screws securing the handset cord to the amplifier circuit board.

(3) Remove the cord strain relief from the base plate.

c. Speaker Mounting Frame

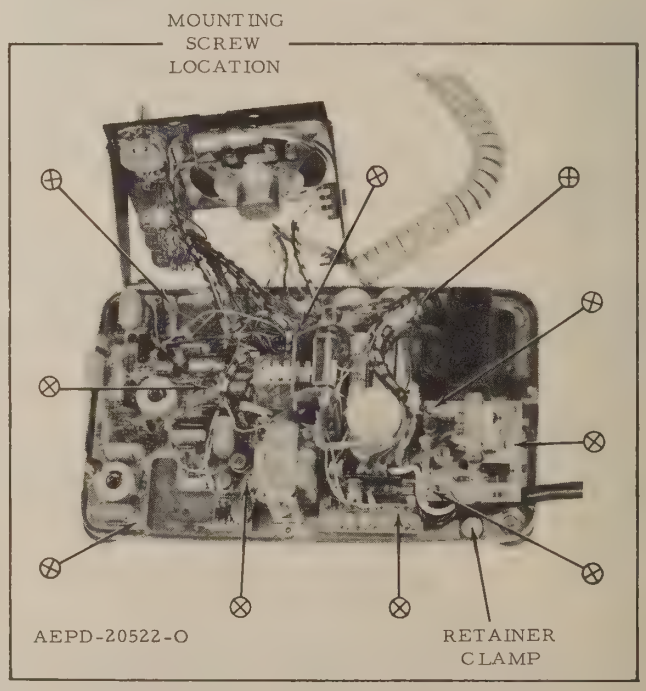
(1) Remove the housing.

(2) Remove the two "Phillips" head screws securing the speaker mounting frame to the base plate.

(3) Withdraw the speaker mounting frame from the base plate and fold out to the side of the base plate.

d. Amplifier Circuit Board

(1) Remove the housing and the speaker mounting frame.



Mounting Screw Locations

(2) Remove the seven "Phillips" head screws securing the circuit board to the base plate.

(3) Loosen the cable clamp that secures the power cable to the base plate.

(4) Remove the handset cable strain relief from the base plate.

(5) Withdraw the circuit board from the base plate. Be careful not to damage the cabling on the hang-up switch.

e. Current Generator Board

(1) Remove the housing.

(2) Remove the three "Phillips" head screws that hold the circuit board to the base plate.

(3) Remove the circuit board from the base plate.

3. INTERCOM SENSITIVITY

Under some circumstances, when parallel remote desk sets are used in unusually close proximity to one another, audio feedback may occur in the course of intercom operation. It is also possible that in systems operating in high ambient noise areas an annoying amount of background noise might accompany intercom messages. Both of the above types of interfering signals may be eliminated by suitably reducing the gain of the intercom amplifier (Q3). This may be done by increasing the value of feedback resistor R13. (Example: The gain of the amplifier is reduced approximately 6 dB when R13 is 100 ohms or 12 dB when R13 is 220 ohms.) When the unit has been modified in this fashion, the operator must speak at a louder level, or be closer to the speaker.

NOTE

Varying the value of resistor R14 will affect only the dc bias of stage Q6 and will not provide the desired gain reduction without seriously affecting the fidelity of the intercom audio.

4. EARPIECE LEVEL

In some instances, such as operation in a very quiet office, the signal level in the handset earpiece may be too high for listening comfort. The signal level can be reduced by connecting a 150-ohm resistor in parallel with the earpiece (fastening it directly to the earpiece screw terminals).

5. TROUBLESHOOTING PROCEDURE

a. General

Servicing requires location of the malfunctioning circuit before the defective component can be isolated and replaced. Since the location of a defective component constitutes the most time-consuming part of troubleshooting, a thorough understanding of the circuits involved will aid the technician in performing efficient servicing. The technician must know how one function affects another; he must be familiar with the overall operation and the procedures necessary to place the remote desk back in operation in the shortest possible time.

The functional and schematic diagrams provide valuable information for troubleshooting purposes. The functional diagram provides signal flow information in a simplified format while the schematic diagram provides the detailed circuitry and the biasing voltages required for isolating malfunctioning components. Generally, it may be assumed that if the remote desk set is totally inoperative, the power inputs or power supplies are defective. However, if the unit operates in the transmit mode but not in the receive mode (or vice-versa), it may be assumed that the power supplies are serviceable and that one or more functional circuits are defective or marginal. By using the functional diagram and deductive processes, the suspected circuit may be readily found.

The following procedures outline a quick sequence of checks using the AUDIO "A" test point (pin 46) for localizing malfunctions.

b. Test Equipment Required

Motorola Solid-State DC Multimeter (or equivalent).
Motorola Solid-State AC Voltmeter (or equivalent).
Motorola Model S1318A FM Signal Generator (or equivalent).
Motorola Transistorized Tone Generator (Model TEK-1A, or equivalent).

NOTE

Although it is not used in the following condensed troubleshooting procedures a general purpose oscilloscope (Motorola Model S1331A, or equivalent), is very useful in localizing problem areas.

c. On-Site Test Procedure

(1) Remove the housing to gain access to the amplifier circuit board.

(2) Check that the power cable(s) is (are) connected.

(3) Using the dc multimeter, check the output level of the low-voltage power supply. The output should be approximately +13.8 volts dc.

(4) Connect the ac voltmeter across pin 46 (AUDIO "A") and chassis ground. Proceed with the test as indicated in the following table.

TEST PROCEDURE

STEP	ACTION	NORMAL INDICATION	ABNORMAL INDICATION	PROBABLE CAUSE	CORRECTIVE ACTION
1	Use P-T-T and transmit a message to outlying mobile or base station.	Meter indicates .8 volts rms and and outlying station receives message. Proceed to step 2.	Meter indicates .8 volt rms but outlying station does not receive message.	Defective transmit amplifier circuitry or transistor switch.	Refer to schematic diagram and measure bias voltages to determine defective component.
			Less than .8 volt rms and no message received.	Defective compression amplifier and/or microphone bias circuitry.	Same as above.
2	Outlying base or mobile transmits a message to the remote desk set.	Meter indicates .8 volt rms and message is heard at console speaker. Console operative.	Meter indicates .8 volt rms but message is not heard.	Defective 1/2-watt amplifier or associated transistor switch.	Refer to schematic diagram and measure bias voltages to determine defective component.
			Less than .8 volt rms and message is not heard.	Defective receive amplifier, its associated transistor switch or compression amplifier.	Same as above.

d. Bench-Test Procedure

(1) Remove the housing.

(2) Connect remote desk set to a 117-volt ac source.

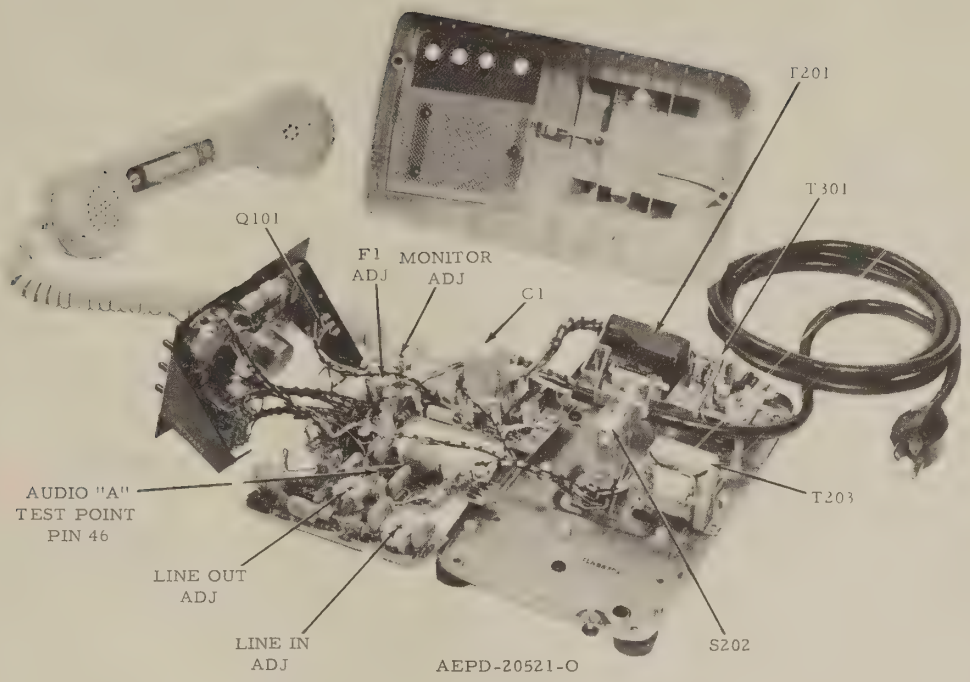
(3) Connect ac voltmeter across pin 46 (AUDIO "A") and chassis ground.

(4) Connect the signal generator across line transformer terminals A and D.

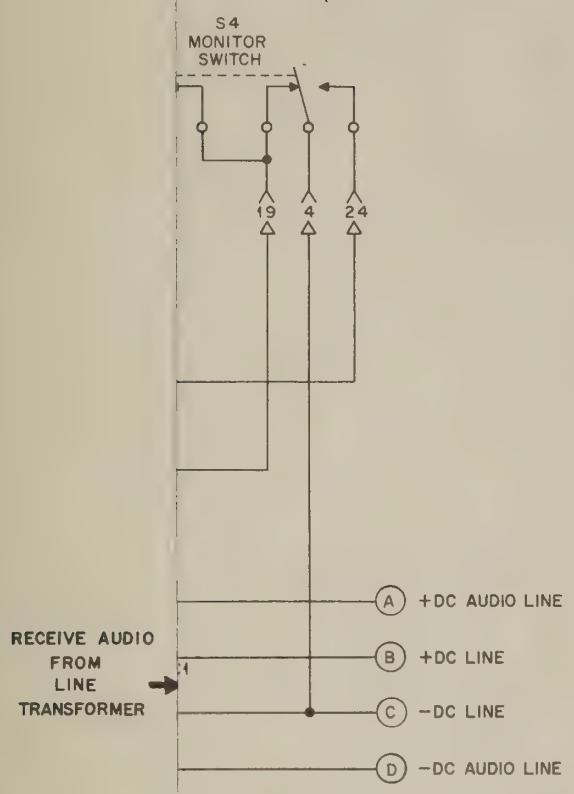
(5) Turn on the signal generator and adjust for a 1000 cycle output at 0 dbm (0.8 volt rms) level.

(6) With the test tone applied, the meter should indicate 0.8 volt rms at the output of the compression amplifier and the tone should be heard via the speaker. If the tone is not audible and 0.8 volt rms is measured at the output of the compression amplifier, check the 1/2-watt amplifier circuitry and its associated switch by taking measurements of the bias voltages. If the tone or 0.8 volt rms is not present, check the receiver amplifier, its associated switch and the compression amplifier circuitry.

(7) Disconnect the audio signal generator from the line transformer and connect it across the microphone input (terminals H and J). Adjust the audio signal generator for a 200 mv output level. Actuate the P-T-T function by connecting a ground to terminal E. With the audio signal generator input present, the meter should indicate 0.8 volt rms at pin 46. If the compression amplifier output indicates normal, use the meter to measure the output of the transmit amplifier. The output level should be approximately +14 dbm. If no output is present, check the transmit amplifier and associated switch circuitry. If 0.8 volt rms is not indicated at the output of the compression amplifier, check the amplifier and its associated circuitry.

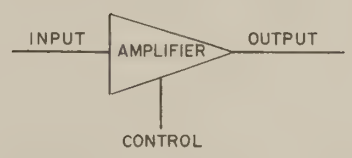


Miscellaneous Component Locations



NOTES:

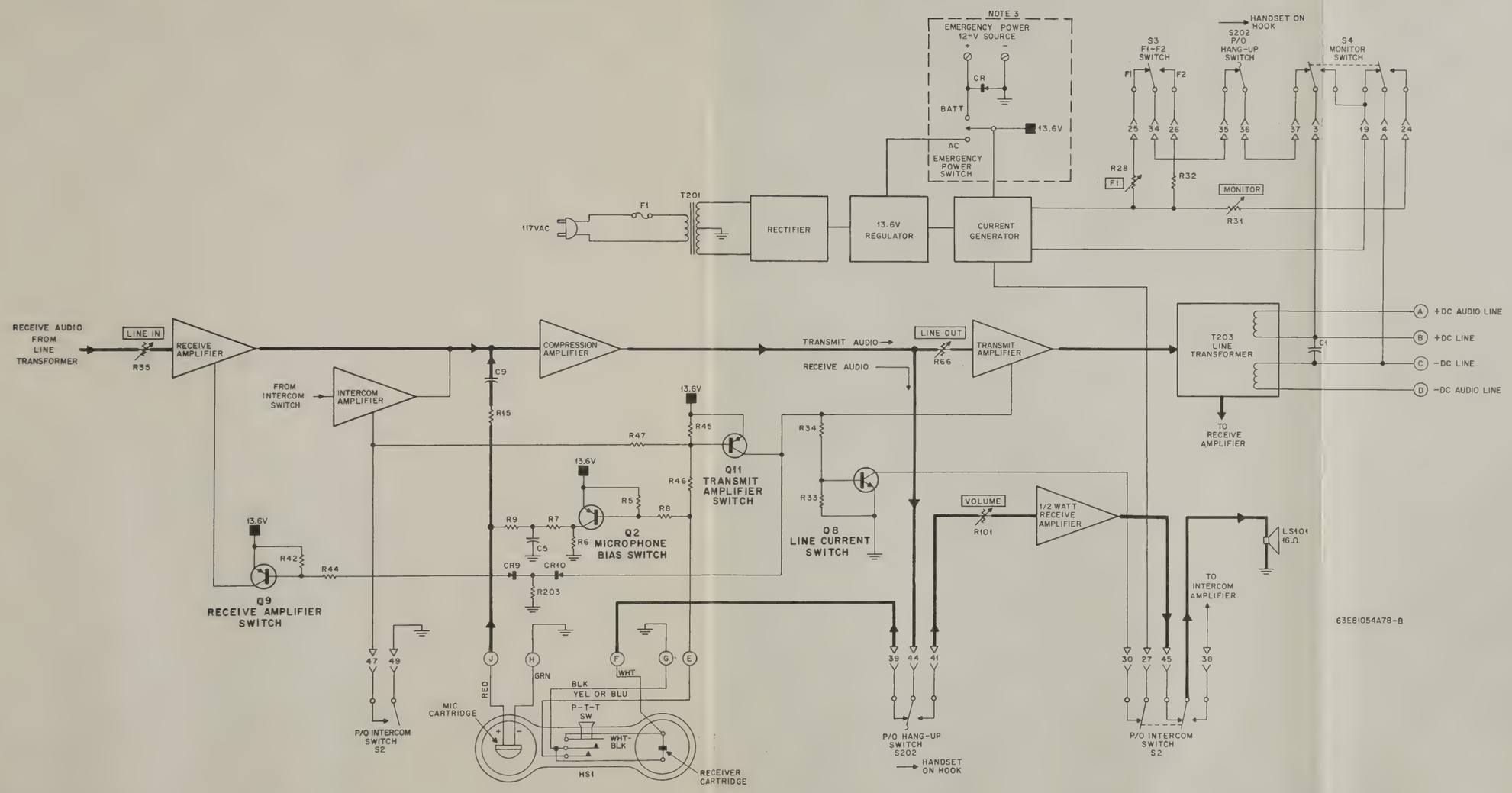
1. HEAVY LINES ARE AUDIO PATHS.

2. 

3. AC-BATTERY SWITCH AND DC SOURCE TERMINALS SUPPLIED ON AC/DC MODELS ONLY.

63E81054A78-B

Simplified Schematic Diagram
Motorola No. 63E81054A78-B
11/14/69-RS



NOTES:

1. HEAVY LINES ARE AUDIO PATHS
2. INPUT — AMPLIFIER — OUTPUT; CONTROL
3. AC-BATTERY SWITCH AND DC SOURCE TERMINALS SUPPLIED ON AC/DC MODELS ONLY.

Simplified Schematic Diagram
Motorola No. 63E81054A78-B
11/14/69-RS

REVISIONS

EPD-19999-H

BOARD AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TLN8686A-1	Q10	WAS 48R869307, M9307	BOTTOM LEFT OF BOARD
	Q12	WAS 48R869299, M9299	LEFT CENTER OF BOARD
TLN8686A-2	R30	WAS 6R6378, 56K	PARTS LIST
	C19, 30	WERE 8D82905G32	PARTS LIST
	Q12	WAS M9571	
	Q10	WAS M9570	
TLN8686A-3	C6	WAS 8D82905G30	PARTS LIST
TLN8686A-4	R81	ADDED 6S129146, 150K	BOTTOM LEFT OF BD.

PARTS LIST

TLN8686A Amplifier Kit — EPD-20307-F

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uf; ±10%; 50 v; unl stated
C1	23D82394A11	450 +150-10%; 35 v
C2	23D82783B07	33 ±20%; 25 v
C3, 5, 8, 10, 15, 26, 33	23D83214C02	15; 25 v
C4, 16	23D82783B31	47 ±20%; 15 v
C6, 11, 32	8D82905G02	.022
C7, 22	8D82905G30	0.1
C9	8D82905G03	.047
C12, 13, 14	21D82428B59	.01 +80-20%; 200 v
C17	8K863994	0.47 ±1%; 200 v
C19, 30	8D82905G11	0.22
C20	8D82905G05	0.15
C21	8D82905G30	.033
C23, 29	23D83214C05	6.8 ±20%; 15 v
C24	21C82187B18	.0015; 100 v
C25	21D82610C44	100 uuf ±5%; 100 v; N220
C27	23D82783B36	39
C28, 31	8D82905G42	0.33
C34	8K863305	2; 200 v
C35	23D83214C02	15; 25 v (p/o E1)
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR1, 2, 15, 16, 17, 18	48C82466H03	silicon
CR3	48D82256C14	silicon; zener type (p/o E1)
CR4	48C82178A04	germanium
CR9, 10, 11, 12, 13, 14, 20	48C82392B03	silicon
CR19	48D82256C20	silicon
		CAPACITOR-DIODE-RESISTOR ASSEMBLY:
E1	1V80783A10	incl. ref items CR3, C35, R80 and 11S134165 TUBING, shrink: #4
		TRANSISTOR: (SEE NOTE)
Q1, 5	48R869428	N-P-N: type M9428
Q3, 4, 7, 8, 12, 14, 15, 16, 17	48R869532 or48R869570	N-P-N: type M9532 N-P-N: type M9570
Q2, 9, 10, 11, 18, 19	48R869514 or48R869571	P-N-P: type M9514 P-N-P: type M9571
Q6	48R869439	P-N-P: type M9439
Q13	48R869539	N-P-N: type M9539
Q20, 21	48R869491	N-P-N: type M9491
		RESISTOR, fixed: ±10%; 1/4 w; unl stated
R1, 2	6S129432	820
R3	6S129775	330
R4, 13	6S131377	15
R5, 6, 33, 40, 42	6S129225	10K
R7, 14, 45, 56, 63, 64, 68	6S127802	1K
R8, 34	6S127807	33K
R9, 61	6S129620	560
R10, 48, 49	6S128902	47K
R11	6S128686	8.2K
R12	6S129433	5.6K
R15	6S127806	27K
R16	6S127804	4.7K
R17	6S129235	1.2K
R18	6S129224	82
R19	6S124A60	3K ±5%
R20	6S124A39	390 ±5%
R21	6S131652	39
R22	6S129662	180
R23	6S129752	270
R24, 25	6S136192	1; 1/2 w
R26, 60	6S129863	390K
R28, 31	18C82291G01	var: 15K ±20%; 1 w
R29	6S5656	12K; 1 w
R30	6R6048	47K ±10%; 1/2 w
R32	6K2029	3.3K ±10%; 2 w
R35	18C83168C04	var: 10K ±20%; 1.5 w
R36	6S127805	15K
R37	6S129232	3.9K
R38	6S128904	18K
R39	6S128688	2.7K
R43	6S128685	22K
R43, 44	6S129230	12K
R46, 47	6S129231	3.3K
R50, 53	6S129526	33K ±5%
R51	6S129887	12K ±5%
R52	6S129863	390
R54	6S129818	820 ±5%
R55	6S129667	22K ±5%
R57	6S129237	6.8K ±5%
R58	6S129753	100
R59, 62	6S129709	470 ±5%
R65	6S127800	220
R66	18C83168C01	500 ±20%; 2 w
R67	6S129269	1.8K
R69, 70	6S129981	3.3K ±5%
R71, 72	6S128904	18K ±5%
R73, 74	6S129662	180
R75, 76	6S124A38	360 ±5%
R77, 78	6K131594	27
R79	6S129708	1.2K ±5%
R80	6S129785	10K (p/o E1)
R81	6S129146	150K
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
SCR1	48C83741C04	silicon; controlled type

TLN8687A Current Generator — EPD-20319-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C301	23D83214C02	15 uf ±20%; 25 v
C302	23C82077C05	300 uf +150-10%; 20 v
C303	21K847070	.0008 uf ±10%; 600 v
		SEMICONDUCTOR DEVICE, diode: (SEE NOTE)
CR302, 303	48C82466H17	silicon
		TRANSISTOR: (SEE NOTE)
Q301, 302	48R869428	N-P-N: type M9428
Q303	48R869571	P-N-P: type M9571
		RESISTOR, fixed: ±10%;
R301	6S128687	6.8K; 1/4 w
R302	6S127804	4.7K; 1/4 w
R303	6S6229	1K; 1/2 w
		TRANSFORMER, power:
T301	25C83233G02	transistor-controlled pri: 4, 6 w/tap (5); total res 0.214 ohms ±10% sec: 1, 3 w/tap (2); total res 58.7 ohms ±10% feedback: 7.9 w/tap (8); total res .076 ohms ±10%

NOTE:

Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

MODEL CHART

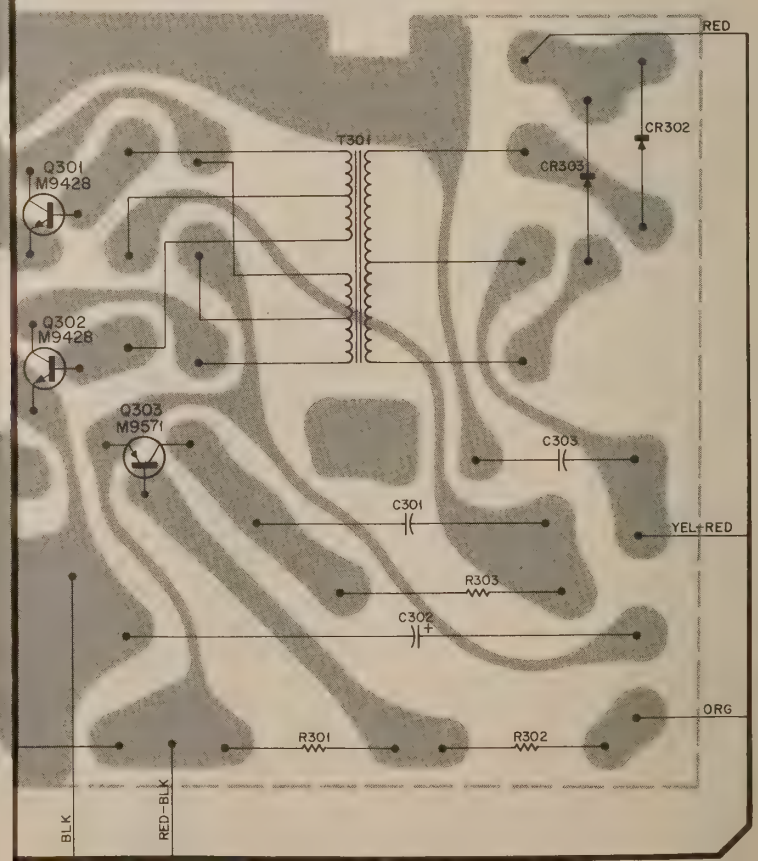
MODEL	SUFFIX	DESCRIPTION
TLN8686A	4	AMPLIFIER KIT
TLN8687A		CURRENT GENERATOR

NOTES:

1. JU1 AND JU2 MUST BE CUT WHEN A FOUR-WIRE CONTROL LINE IS USED.
2. JU3 IS OMITTED WHEN AN INTERCOM SWITCH IS USED.
3. JU4 MUST BE CUT IN REMOTE DESK SETS THAT ARE PARALLELED FOR DISPATCH POINT OPERATION.

EPD-20578-C

CURRENT GENERATOR



PREVIOUS REVISIONS AND PARTS LIST SHOWN ON FRONT OF THIS DIAGRAM

Remote Desk Set
Circuit Board Detail
Motorola No. EPD-19999-J
7/29/74-PO

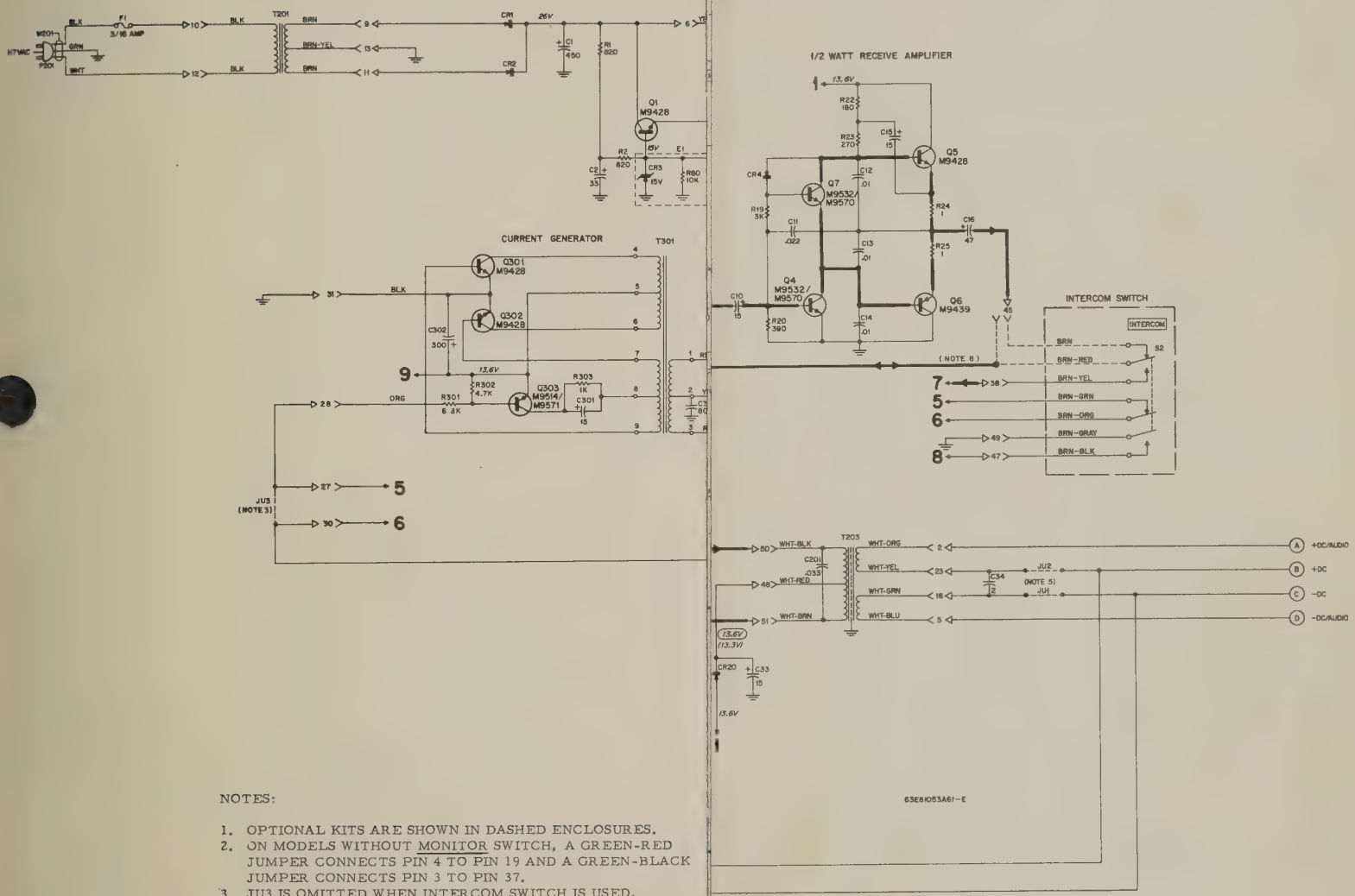
MISCELLANEOUS ITEMS MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
TLN8691A		INTERCOM SWITCH KIT
TLN8692A		MONITOR SWITCH KIT
TLN8693A		F1-F2 SWITCH KIT
TLN8694A		GRILLE AND HARDWARE KIT
TKN6323A		BATTERY CABLE KIT (117 V AC/12 V DC)
TLN8680A	1	HOUSING AND HANDSET (BLACK)
TLN8681A	1	HOUSING AND HANDSET (RED)
TLN8682A	1	HOUSING AND HANDSET (GREEN)
TLN8683A	1	HOUSING AND HANDSET (BLUE)
TLN8684A	1	HOUSING AND HANDSET (BEIGE)
TLN8685A	1	HOUSING AND HANDSET (WHITE)

CHASSIS MODEL TABLE

SUFFIX	MODEL	SUFFIX	DESCRIPTION
	TLN8678A		DESK SET CHASSIS (117 V AC)
	TLN8686A	4	AMPLIFIER CIRCUIT BOARD
	TLN8687A		CURRENT GENERATOR
	TLN8690A		FRAME AND HARDWARE KIT
	TLN8679A		DESK SET CHASSIS (117 V AC/12 V DC)
	TLN8686A	3	AMPLIFIER CIRCUIT BOARD
	TLN8687A		CURRENT GENERATOR
	TLN8690A		FRAME AND HARDWARE KIT

EPD-20523-D



NOTES:

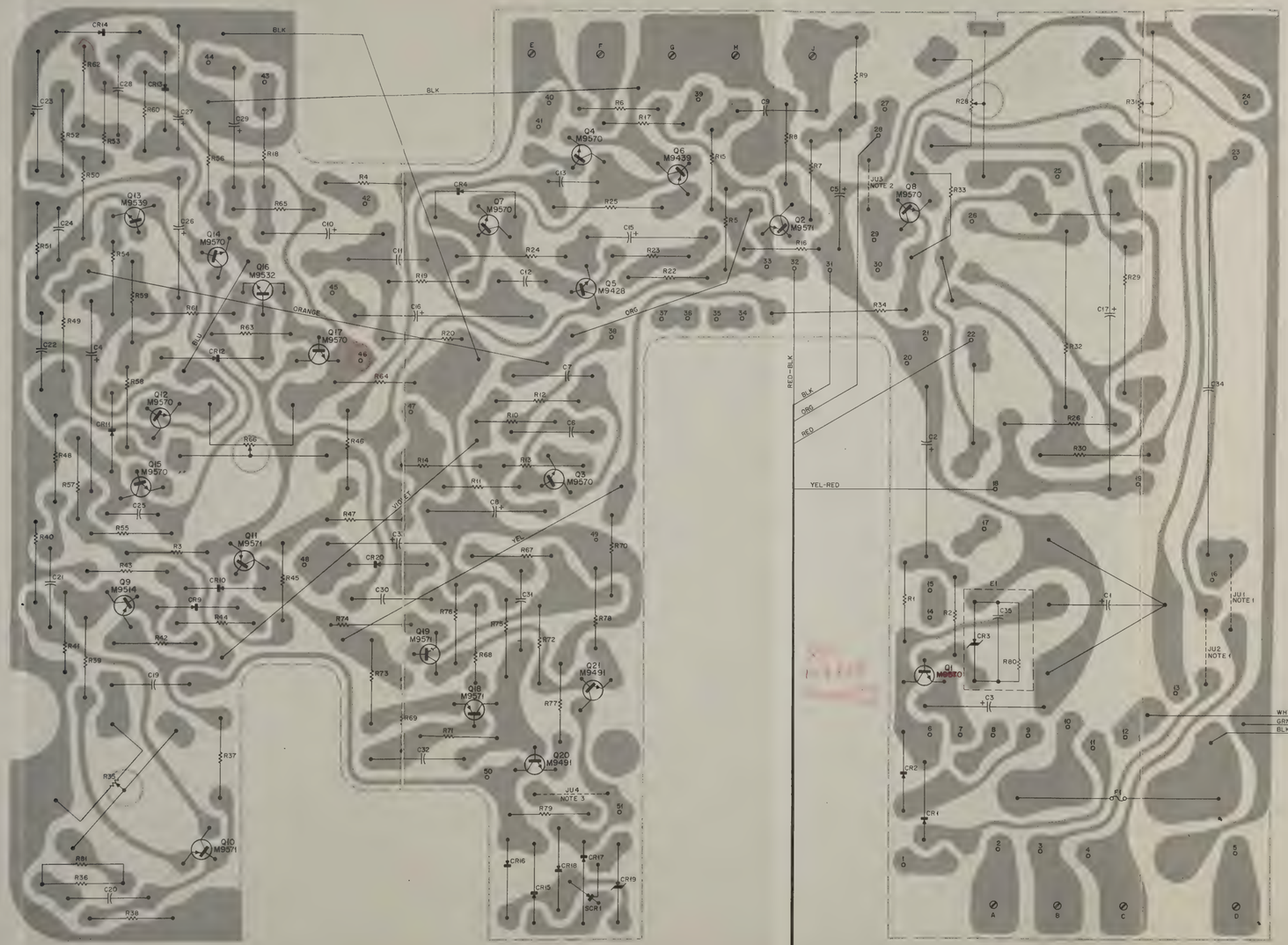
1. OPTIONAL KITS ARE SHOWN IN DASHED ENCLOSURES.
2. ON MODELS WITHOUT MONITOR SWITCH, A GREEN-RED JUMPER CONNECTS PIN 4 TO PIN 19 AND A GREEN-BLACK JUMPER CONNECTS PIN 3 TO PIN 37.
3. JU3 IS OMITTED WHEN INTERCOM SWITCH IS USED.
4. JU4 MUST BE CUT IN UNITS THAT ARE PARALLELED FOR DISPATCH POINT OPERATION.
5. JU1 AND JU2 MUST BE CUT WHEN A FOUR-WIRE CONTROL LINE SYSTEM IS USED.
6. ON MODELS WITHOUT F1-F2 SWITCH, THE GRAY-GREEN LEAD CONNECTS TO PIN 26.
7. CONNECTION FOR AC POWERED MODELS ONLY.
8. ON MODELS WITHOUT INTERCOM SWITCH, A BROWN-RED JUMPER CONNECTS PIN 45 TO THE SPEAKER.
9. VOLTAGE READINGS ARE ±20% (20,000 OHM/VOLT METER).
10. ▭ = VOLTAGE DURING RECEIVE OPERATION.
    ( ) = VOLTAGE DURING TRANSMIT OPERATION.
11. R30 MUST BE CHANGED TO 39K, 1/2 WATT WHEN USED WITH RELAY-TYPE REMOTE CONTROL UNITS, EXCEPT TLN1126A SUFFIX-1 OR LATER.
12. REMOVE R36 FOR LINE INPUT LEVELS ABOVE 0 dBm (.77 V) AT THE INPUT TO THE DESK SET.

EPD-20314-B

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Remote Desk Set
Schematic Diagram
Motorola No. 63E81053A61-E
6/20/72-RS

AMPLIFIER



VIEWED FROM COMPONENT SIDE

MODEL CHART

MODEL	SUFFIX	DESCRIPTION
TLN4687A	4	AMPLIFIER KIT
TLN4687A		CURRENT GENERATOR

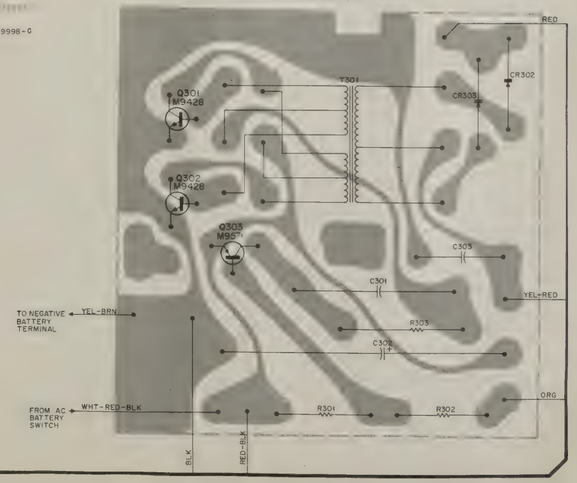
NOTES:

1. JU1 AND JU2 MUST BE CUT WHEN A FOUR-WIRE CONTROL LINE IS USED.
2. JU3 IS OMITTED WHEN AN INTERCOM SWITCH IS USED.
3. JU4 MUST BE CUT IN REMOTE DESK SETS THAT ARE PARALLELED FOR DISPATCH POINT OPERATION.

EPD-20578-C

OL-EEPD-19998-G

CURRENT GENERATOR



PREVIOUS REVISIONS AND PARTS LIST SHOWN ON FRONT OF THIS DIAGRAM

Remote Desk Set
Circuit Board Detail
Motorola No. EPD-19999-J
7/29/74-PO

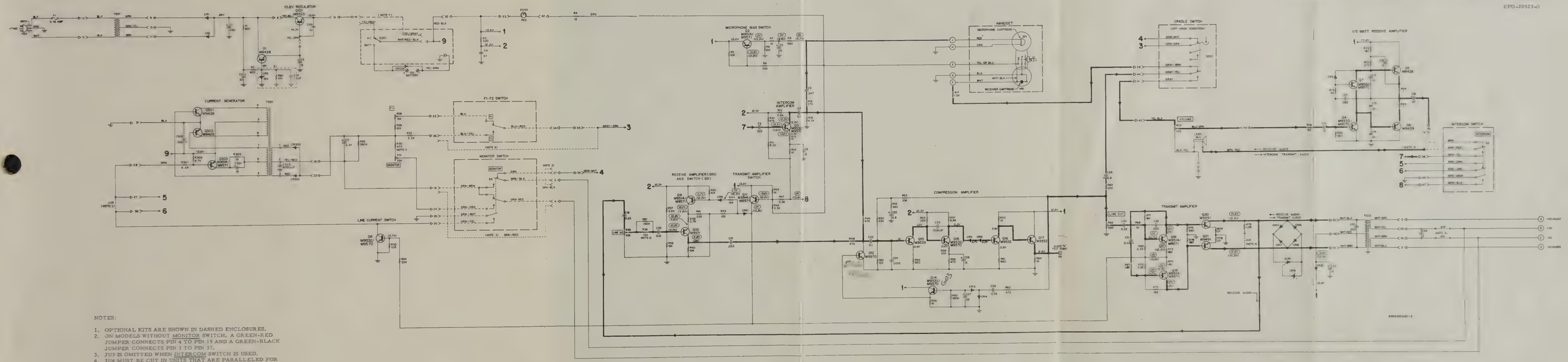
MISCELLANEOUS ITEMS MODEL TABLE

MODEL	SUFFIX	DESCRIPTION
TLN8691A		INTERCOM SWITCH KIT
TLN8692A		MONITOR SWITCH KIT
TLN8693A		F1-F2 SWITCH KIT
TLN8694A		GRILLE AND HARDWARE KIT
[illegible]		BATTERY CABLE KIT (117 V AC/12 V DC)
TLN8681A	1	HOUSING AND HANDSET (BLACK)
TLN8681A	1	HOUSING AND HANDSET (RED)
TLN8682A	1	HOUSING AND HANDSET (GREEN)
TLN8683A	1	HOUSING AND HANDSET (BLUE)
TLN8684A	1	HOUSING AND HANDSET (BEIGE)
TLN8685A	1	HOUSING AND HANDSET (WHITE)

CHASSIS MODEL TABLE

MODEL	SUFFIX	MODEL	SUFFIX	DESCRIPTION
TLN1188A		TLN8678A		DESK SET CHASSIS (117 V AC)
		TLN8686A	4	AMPLIFIER CIRCUIT BOARD
		TLN8687A		CURRENT GENERATOR
		TLN8690A		FRAME AND HARDWARE KIT
TLN1189A		TLN8679A		DESK SET CHASSIS (117 V AC/12 V DC)
		TLN8686A	5	AMPLIFIER CIRCUIT BOARD
		TLN8687A		CURRENT GENERATOR
		TLN8690A		FRAME AND HARDWARE KIT

EPD-20523-D



NOTES:

1. OPTIONAL KITS ARE SHOWN IN DASHED ENCLOSURES.
2. ON MODELS WITHOUT MONITOR SWITCH, A GREEN-RED JUMPER CONNECTS PIN 4 TO PIN 19 AND A GREEN-BLACK JUMPER CONNECTS PIN 3 TO PIN 37.
3. JU3 IS OMITTED WHEN INTERCOM SWITCH IS USED.
4. JU4 MUST BE CUT IN UNITS THAT ARE PARALLELED FOR DISPATCH POINT OPERATION.
5. JU1 AND JU2 MUST BE CUT WHEN A FOUR-WIRE CONTROL LINE SYSTEM IS USED.
6. ON MODELS WITHOUT F1-F2 SWITCH, THE GRAY-GREEN LEAD CONNECTS TO PIN 26.
7. CONNECTION FOR AC POWERED MODELS ONLY.
8. ON MODELS WITHOUT INTERCOM SWITCH, A BROWN-RED JUMPER CONNECTS PIN 45 TO THE SPEAKER.
9. VOLTAGE READINGS ARE ±20% (20,000 OHM/VOLT METER).
10. ▭ = VOLTAGE DURING RECEIVE OPERATION.
    ( ) = VOLTAGE DURING TRANSMIT OPERATION.
11. R30 MUST BE CHANGED TO 39K, 1/2 WATT WHEN USED WITH RELAY-TYPE REMOTE CONTROL UNITS, EXCEPT TLN1126A SUFFIX-1 OR LATER.
12. REMOVE R36 FOR LINE INPUT LEVELS ABOVE 0 dBm (.77 V) AT THE INPUT TO THE DESK SET.

EPD-20314-B

PREVIOUS REVISIONS AND PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

Remote Desk Set
Schematic Diagram
Motorola No. 63E81053A61-E
6/20/72-RS

REVISIONS

63E81053A61-E

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION	REFER TO CIRCUIT BOARD
TLN8686A				AMPLIFIER BD EPD-19999-B
TLN8686A-1, 2				AMPLIFIER BD EPD-19999-D
TLN8686A-3				AMPLIFIER BD EPD-19999-G
TLN8686A-4				AMPLIFIER BD EPD-19999-H

PARTS LIST

TLN8690A Frame & Components Kit — EPD-20317-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C101	21C82372C03	CAPACITOR, fixed: 0.1 uf +80-20%; 25 v
DS101	65C82010C03	LAMP, incandescent: 14 v; .08 a; type No. 756; does not incl 26B83622G01 SHIELD
F101	65K892098	FUSE, cartridge: 1-1/4" x 1/4" slow-blow type; 3/16 a; 125 v
LS101	50D83205B03	LOUDSPEAKER, magnetic: 3"; square; imped 16 ohms
Q101	48R869576	TRANSISTOR: (SEE NOTE) N-P-N; type M9576
R101	18D82700D08	RESISTOR, variable: 100 ±20%; 0.5 w

TLN8678A Chassis Kit (117 V AC)
TLN8679A Chassis Kit (117 V AC/12 V DC) — EPD-20318-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C201	8K863006	CAPACITOR, fixed: .033 ±10%; 200 v
CR304	48C82525G09	SEMICONDUCTOR DEVICE, diode: (SEE NOTE) silicon
P201		CONNECTOR, plug: (p/o W201)
S201	40B83204B01	SWITCH, slide: dpdt
S202	40D83461G03	hook: open leaf type: 1 form "A" 1 form "B", 1 form "C"
T201	25C83274G02	TRANSFORMER, power: 117 v ac: pri: BLK, BLK; res 69.1 ohms sec: BRN, BRN w/BRN-YEL tap; res 4.5 ohms
T203	25C83145G02	TRANSFORMER, AF: pri: 5, 7 w/tap (6); total res 50 ohms max sec No. 1: 1, 2; res 25 ohms max sec No. 2: 3, 4: res 25 ohms max
W201	30C83211C03	CABLE ASSEMBLY, power: incl a 3-conductor cable (each conductor No. 18 ga, str); also incl a "molded-on" 3-cont male plug (P201) and a "molded-on" strain relief bushing; length overall 6 ft

TKN6323A Battery Cable & Fuse Kit — EPD-20320-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
F401	65S61688	FUSE, cartridge: 1-1/4" x 1/4" 4 a; 250 v
W401	30C83772B01	CABLE ASSEMBLY, power: 2 conductor; each conductor No. 16 ga, str; 72" length req'd
XF401		FUSEHOLDER: c/o: 14A82882A01 BODY 14A82883A01 CAP 42A82884A01 CLIP, cont; 2 req'd 41A82885A01 SPRING

Housing & Handset Kits
TLN8680A-1 (Black)
TLN8681A-1 (Red)
TLN8682A-1 (Green)
TLN8683A-1 (Blue)
TLN8684A-1 (Beige)
TLN8685A-1 (White) — EPD-20321-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
DP1	59D83272G01 or 59D82933C02	MICROPHONE ELEMENT: incl transistor amplifier HANDSET, telephone: (incl receiver element; ref. part DP1 and "push-to-talk" switch (S1); see part numbers listed below:
HS1	1V80704B52	(black)
	1V80704B53	(red)
	1V80704B54	(green)
	1V80704B55	(blue)
	1V80704B56	(beige)
S1		SWITCH ASSEMBLY: P/O HS1
	40C84087A01	BLACK
	40C84087A02	WHITE
	40C84087A03	RED
	40C84087A04	BLUE
	40C84087A05	BEIGE
	40C84087A06	GREEN
NON-REFERENCED ITEMS (p/o HS1)		
	15B84053A01	COVER, switch
	59C84058A01	CARTRIDGE, handset (Rcvr.)
	3S124432	SCREW, #4-40 x 1/4"; "Phillips" flat head
		CAP, handset (Rcvr.)
	15B84054A01	BLACK
	15B84054A02	WHITE
	15B84054A03	RED
	15B84054A04	BLUE
	15B84054A05	BEIGE
	15B84054A06	GREEN
		CAP, handset (Xmtr.)
	15B84055A01	BLACK
	15B84055A02	WHITE
	15B84055A03	RED
	15B84055A04	BLUE
	15B84055A05	BEIGE
	15B84055A06	GREEN
		CORD, handset: coiled
	1V80704B64	BLACK
	1V80704B65	WHITE
	1V80704B66	RED
	1V80704B67	BLUE
	1V80704B68	BEIGE
	1V80704B69	GREEN
		HOUSING, handset
	15C84059A01	BLACK
	15C84059A02	WHITE
	15C84059A03	RED
	15C84059A04	BLUE
	15C84059A05	BEIGE
	15C84059A06	GREEN

TLN8691A Intercom Switch Kit — EPD-20322-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
S2	40D83334G03	SWITCH, lever: open leaf type: non-locking; cont, 1 form "A", 1 form "B", 1 form "C"

TLN8693A F1-F2 Switch Kit — EPD-20323-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
S3	40D83334G01	SWITCH, lever: open leaf type: locking; cont, 1 form "C"

TLN8692A Monitor Switch Kit — EPD-20324-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
S4	40D83334G02	SWITCH, lever: open leaf type: non-locking; cont, 1 form "A", 2 form "C"

TLN8694A Grille & Hardware Kit — EPD-20325-O

NON-REFERENCED ITEMS		
	33B83336G01	ESCUTCHEON (Models T1375A & T1378A)
	33B83346G02	ESCUTCHEON (Models T1376A & T1379A)
	33B83336G03	ESCUTCHEON (Models T1377A & T1380A)

NOTE:

Replacement transistors and diodes must be ordered by Motorola part number only for optimum performance.